CLAIMS

What is claimed is:

1. A quantization error compensation apparatus comprising:

a frequency dividing unit to divide an input current image signal expressed by a level 1 into a first high-frequency signal and a low-frequency signal, wherein the first high-frequency signal is expressed by a level 2 extended from the level 1 and the low-frequency signal is expressed by a level 3 extended from the level 1, and to output the divided signal;

a resolution-changing unit to cut m number of Least Significant Bits (LSB) of the first high-frequency signal and to insert a predetermined signal into a position from which the m LSBs were cut to output a second high-frequency signal;

an adding unit to add the low-frequency signal and the second high-frequency signal to generate a composite signal;

a quantization unit to cut n number of the LSBs of the composite signal and to output the cut composite signal and the n number of a bit signal;

an equalizing unit to equalize the cut composite signal according to a predetermined brightness equalizing pattern and to output a first brightness equalizing value with respect to a brightness level of a pixel of the current image signal and a second brightness equalizing value with respect to a next level of the brightness level of the pixel of the current image signal;

a compensation value calculating unit to calculate a compensation value using the n number of the bit signal and a difference value between the first brightness equalizing value and the second brightness equalizing value; and

a compensation unit to add the calculated compensation value and the first brightness equalizing value and to output an added value,

wherein m and n are integers.

2. The quantization error compensation apparatus of claim 1, wherein the frequency dividing unit comprises:

a high pass filter to extract a frequency signal at or greater than a predetermined frequency from the current image signal expressed by the level 1 and changing the level 1 to the level 2 to output the first high-frequency signal; and

a low pass filter to extract a frequency signal smaller than the predetermined frequency from the current image signal expressed by the level 1 and changing the level 1 to the level 3 to thereby output the low-frequency signal.

3. The quantization error compensation apparatus of claim 2, wherein the high pass filter and the low pass filter are mirror filters.

4. The quantization error compensation apparatus of claim 1, wherein the predetermined signal to be inserted into the position from which the m LSBs were cut is a signal '0'.

5. The quantization error compensation apparatus of claim 1, wherein the equalizing unit includes a look-up table which stores the brightness equalizing pattern.

6. The quantization error compensation apparatus of claim 1, wherein the compensation value calculating unit comprises:

a subtracting portion to calculate a difference value between the first brightness equalizing value and the second brightness equalizing value; and

a multiplying portion to multiply the difference value by the cut n number of the bit signal to obtain the compensation value.

7. The quantization error compensation apparatus of claim 1, wherein the m and n are a same positive integer.

8. A quantization error compensation method, comprising:

dividing an input current image signal expressed by a level 1 into a first high-frequency signal and a low-frequency signal, the first high-frequency signal being expressed by a level 2 extended from the level 1 and the low-frequency signal being expressed by a level 3 extended from the level 1, and outputting the divided signal;

cutting m number of Least Significant Bits (LSB) of the first high-frequency signal and inserting a predetermined signal into a position from which the m LSBs were cut to output a second high-frequency signal;

adding the low-frequency signal and the second high-frequency signal to create a composite signal;

quantizing the composite signal by cutting an n number of the LSBs of the created composite signal and outputting the cut composite signal and the n number of a bit signal;

equalizing the cut composite signal according to a predetermined brightness equalizing pattern to produce a first brightness equalizing value with respect to a brightness level of a pixel of the current image signal and a second brightness equalizing value with respect to a next level of the brightness level of the pixel of the current image signal;

calculating a compensation value by using the cut n number of the bit signal and a difference value between the first and second brightness equalizing values; and

adding the calculated compensation value and the first brightness equalizing value and outputting an added value,

wherein m and n are integers.

9. The quantization error compensation method of claim 8, wherein the predetermined signal to be inserted into the cut position is a signal '0'.

10. The quantization error compensation method of claim 8, wherein the predetermined brightness equalizing pattern is stored in a look-up table.

11. The quantization error compensation method of claim 8, wherein the calculating the compensation value comprises:

calculating the difference value between the first brightness equalizing value and the second brightness equalizing value; and

multiplying the difference value by the cut n number of the bit signal to obtain the compensation value.

12. The quantization error compensation method of claim 8, wherein the m and n are a same positive integer.

13. A quantization error compensation apparatus for adjusting a brightness level of a current image signal, the apparatus comprising:

a replacement unit to replace a portion of the current image signal within a predetermined frequency band with a predetermined signal so as to produce a composite signal;

a quantization unit to remove a portion of the composite signal and to output the cut composite signal and the portion of the composite signal;

an equalizing unit to equalize the cut composite signal according to a predetermined brightness equalizing pattern and to output a first brightness equalizing value for the brightness level of the current image signal and a second brightness equalizing value for a next brightness level of the current image signal;

a calculating unit to calculate a compensation value using the portion of the composite signal and the first and second brightness equalizing values; and

a compensation unit to combine the compensation value and the first brightness equalizing value so as to compensate an area of the current image signal at which occurs a change in the brightness level.

14. The quantization error compensation apparatus of claim 13, wherein the replacement unit comprises:

a frequency dividing unit to divide the current image signal into a first signal and a second signal;

a resolution-changing unit to replace a first portion of the first signal with the predetermined signal so as to produce a third signal; and

a combining unit to combine the second signal and the third signal to generate the composite signal.

15. The quantization error compensation apparatus of claim 14, wherein:

the current image signal is expressed by a level 1;

the first signal is a first high-frequency signal expressed by a level 2 extended from the level 1; and

the second signal is a low-frequency signal expressed by a level 3 extended from the level 1.

16. The quantization error compensation apparatus of claim 14, wherein the resolution-changing unit cuts m number of Least Significant Bits (LSB) of the first signal and inserts the predetermined signal into a position from which the m LSBs were cut to produce the third signal.

17. The quantization error compensation apparatus of claim 13, wherein the quantization unit cuts n number of Least Significant Bits (LSB) of the composite signal and outputs the n number of a bit signal as the portion of the composite signal.

18. The quantization error compensation apparatus of claim 13, wherein, in calculating the compensation value, the calculating unit obtains a difference value between the first and second brightness equalizing values and multiplies the difference value by the portion of the composite signal.

19. The quantization error compensation apparatus of claim 18, wherein the quantization unit cuts n number of Least Significant Bits (LSB) of the composite signal and outputs the n number of a bit signal as the portion of the composite signal.

20. The quantization error compensation apparatus of claim 14, wherein:

the frequency dividing unit divides the current image signal into the first signal having a first number of bits and the second signal having a second number of bits;

the resolution-changing unit includes an up-scaling unit which produces the third signal having the second number of bits; and

the combining unit combines the second signal and the third signal to generate the composite signal having the second number of bits.

21. The quantization error compensation apparatus of claim 20, wherein:

the quantization unit cuts n number of Least Significant Bits (LSB) of the composite signal and outputs the n number of a bit signal as the portion of the composite signal; and

the compensation value is calculated as follows:

Compensation (y)=(LUT(y+1)-LUT(y))*(n number of the bit signal)/A

where the compensation (y) denotes the compensation value,

the LUT(y+1) denotes the second brightness equalizing value with respect to the next brightness level of a pixel of the current image signal,

the LUT(y) denotes the first brightness equalizing value with respect to the brightness level of the pixel of the current image signal, and

A is a difference between the first signal and the second signal.

22. A computer readable medium encoded with processing instructions for performing a method of compensating a quantization error in a current image signal using a computer, the method comprising:

replacing a portion of the current image signal within a predetermined frequency band with a predetermined signal so as to produce a composite signal;

quantizing the composite signal including removing a portion of the composite signal and outputting the cut composite signal and the portion of the composite signal;

equalizing the cut composite signal according to a predetermined brightness equalizing pattern so as to output a first brightness equalizing value for the brightness level of the current image signal and a second brightness equalizing value for a next brightness level of the current image signal;

calculating a compensation value using the portion of the composite signal and the first and second brightness equalizing values; and

combining the compensation value and the first brightness equalizing value so as to compensate an area of the current image signal at which occurs a change in the brightness level.

23. The computer readable medium of claim 22, wherein the replacing the portion comprises:

dividing the current image signal into a first signal and a second signal;

replacing a first portion of the first signal with the predetermined signal so as to produce a third signal; and

combining the second signal and the third signal to generate the composite signal.

24. The computer readable medium of claim 23, wherein:

the current image signal is expressed by a level 1;

the first signal is a first high-frequency signal expressed by a level 2 extended from the level 1; and

the second signal is a low-frequency signal expressed by a level 3 extended from the level 1.

25. The computer readable medium of claim 23, wherein the replacing the first portion comprises:

cutting m number of Least Significant Bits (LSB) of the first signal, and

inserting the predetermined signal into a position from which the m LSBs were cut to produce the third signal.

26. The computer readable medium of claim 22, wherein the quantizing the composite signal comprises:

cutting n number of Least Significant Bits (LSB) of the composite signal, and

outputting the n number of a bit signal as the portion of the composite signal.

27. The computer readable medium of claim 22, wherein the calculating the compensation value comprises:

obtaining a difference value between the first and second brightness equalizing values, and

multiplying the difference value by the portion of the composite signal.

28. The computer readable medium of claim 27, wherein the quantizing the composite signal comprises:

cutting n number of Least Significant Bits (LSB) of the composite signal, and

outputting the n number of a bit signal as the portion of the composite signal.

29. The computer readable medium of claim 23, wherein:

the dividing the current image signal comprises dividing the current image signal into the first signal having a first number of bits and the second signal having a second number of bits;

the replacing the first portion of the first signal further comprises producing the third signal having the second number of bits; and

the combing the second signal and the third signal comprising combining the second signal and the third signal to generate the composite signal having the second number of bits.

30. The computer readable medium of claim 29, wherein:

the quantizing the composite signal comprises:

cutting n number of Least Significant Bits (LSB) of the composite signal, and

outputting the n number of a bit signal as the portion of the composite signal; and

the calculating the compensation value comprises:

Compensation (y)=(LUT(y+1)-LUT(y))*(n number of the bit signal)/A

where the compensation (y) denotes the compensation value,

the LUT(y+1) denotes the second brightness equalizing value with respect to the next brightness level of a pixel of the current image signal,

the LUT(y) denotes the first brightness equalizing value with respect to the brightness level of the pixel of the current image signal, and

A is a difference between the first signal and the second signal.